

4-23-2007

## 2007 - The Twelfth Annual Symposium of Student Scholars

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*The Twelfth Annual  
Symposium  
of  
Student Scholars*



*Recognizing Excellence  
in  
Student Scholarship*

*April 23, 2007*



# *Twelfth Annual Symposium of Student Scholars*

**April 23, 2007**

## **Program**

6:00 p.m.                      Welcome  
                                    Dr. Bill Ensign  
                                    Co-chair, Student Scholarship Symposium

6:00 p.m. – 9:00 p.m.      Posters  
                                    Presenters available to discuss their works

### Organizing Committee

Dr. Bill Ensign, Committee co-chair, Associate Professor of Biology  
Dr. Marina Koether, Committee co-chair, Associate Professor of Chemistry  
Ms. Carol Pope, Committee co-chair, Assistant Director for disabled Student  
Support Services, Advisor for Phi Kappa Phi

Special thanks to Phi Kappa Phi for support of the reception and printing of the  
abstract booklet.

Special thanks to the Kennesaw State Chapter of Sigma Xi for providing funds  
for the participant recognition awards.

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# College of The Arts

## **“The Road to Freedom” Curricular Unit for Art Education - *liadonnasanova Owens-Williamson and Dr. Sandra Bird***

### **School of Nursing**

“The Road To Freedom” is a thematic interdisciplinary unit that was designed by liadonnasanova Owens-Williamson during the Fall 2006 semester at KSU. This group of lessons takes its intended audience along the Underground Railroad with the aid of a slave’s ghost, Ida Mae. Ida Mae (liadonnasanova Owens-Williamson) tells her audience about slavery and survival along the ‘Railroad’ which is filled with song and emotion and explains how the “coded quilt” played an integral part in leading runaway slaves to freedom.

This material will be presented at the symposium with the presenter in full slavery attire. The table display will consist of a three-panel presentation board, a tape recorder with recorded “negro spirituals”, a hardcopy of the thematic lessons, props/exemplars from the lessons and a laptop with a powerpoint of Ida Mae’s scrapbook on its monitor screen. Using storytelling, Ida Mae will walk her audience through this very important period in history with a primary focus on art in history, art production, art aesthetics and art criticism.

This lesson was developed for Bird’s ARED 4410 Curriculum Models and Assessment in Art course. Several lessons from the unit have been field tested in a Cobb County elementary school during lia’s student teaching practicum course.



# **College of Health and Human Services**

## **Spiritual Care in Nursing Education - *Callen Rich and Dr. Lois Robley, RN***

### **School of Nursing**

Spirituality is a concept without precise definition; it has eluded scholars because of its abstract and subjective nature. Spiritual nursing care is defined broadly as "the activities and ways of being that bring spiritual quality of life, well-being and function—all of which are dimensions of health—to clients" (McEwen, 2005, p.163; Taylor, 2002), but many healthcare professionals don't truly comprehend what it entails. There are several common barriers to spiritual care, many of which could be resolved with proper education at the undergraduate level. Few university programs have investigated innovative and successful ways of incorporating spiritual care into nursing education. Excellent education on spiritual care would prompt students to evaluate their own spirituality, shape their perceptions on spiritual care, and encourage them to consciously address spiritual needs in patients. Some suggested spiritual care teaching methods include storytelling, reflective discussion, role playing, care mapping, self awareness activities, group work, journaling, and case studies (Bond et. al., 2004; McSherry, 2006; Mitchell, Bennett, & Manfrin-Ledet, 2006; Pimple et. al, 2003). The purpose of this presentation is to define spiritual care and explore the ways in which spiritual care can be incorporated as a fundamental component of professional nursing education. An example of how this content is being infused into the undergraduate nursing curriculum at KSU is included.

## College of Humanities and Social Sciences

**Pablo Neruda: Exploitation and Corruption in Latin America - *Rosaria Acosta and Dr. June Laval***

### Department of Foreign Languages

While the first poems of the great Chilean poet were intensely personal and lyrical, much of his later work was fiercely political. In the poem "La United Fruit Co.", he criticized foreign enterprise in Latin America, specifically that of the United States. In a mocking, somewhat humorous manner, he describes how the multinationals arrive on the scene and the land is divided:

Cuando sonó la trompeta, estuvo  
todo preparado en la tierra,  
y Jehová repartió el mundo  
a Coca Cola Inc., Anaconda,  
Ford Motors, y otras entidades:  
la Compañía Frutera Inc.  
se reservó lo más jugoso...

Neruda joined the Communist Party in 1943. He was highly critical of the economic imperialism of the United States. We will examine this criticism in the poem "La United Fruit Co.". In another poem, "La Standard Oil Co.", Neruda criticizes the exploitation of Latin American resources by North American companies. At the same time, the poet criticizes Latin American dictators alluding to the dictatorship of flies, calling them by name: moscas Trujillos, moscas Tachos, moscas Carías, moscas Martínez, moscas Ubico...

Bolivia and Paraguay went to war to decide which country had the right to award oil contracts for the jungles of Chaco (1932-1935). The real adversaries were Gulf and Standard Oil. Standard Oil emerged as the victor. This is the sad story of "Un presidente asesinado por una gota de petróleo". At the end of the poem, we see in the background, the familiar Standard Oil sign, symbolic of the victory of foreign interest over the rights of Latin American countries.

## **Experimenting with Pedagogical Methods in German - *Laura Dunning and Dr. Sabine Smith***

### **Department of Foreign Languages**

For 6 years, I have been employed as a teacher's assistant in the first grade class at the German School of Atlanta. Throughout this time, I have been exposed to several different teaching styles and began wondering which style was most effective at reaching the students. Since I was looking for a way to merge my interests as a German teacher and a student of exercise and health science, I decided to research more interactive teaching methods. My chief objective in this experiment was to compare the effectiveness of traditional, frontal teaching methodology to a more active, student-centered approach incorporating movement. I developed and implemented 10 activities with various themes, which I tested during my half of the lesson. To test the effect on the students, I developed a beginning- and end-term evaluation dealing with questions from both the main teacher's and my own material. Upon analyzing the results, I found that the students had indeed retained the material taught in my lessons to a greater extent than in the frontal method taught by the other teacher. I applied these findings in a secondary internship as a coordinator of the new Learn and Serve program, an alliance of Big Shanty Elementary School and Kennesaw State University, in which German and French students volunteer their time to teach basic language skills to the elementary students. The German volunteer students were divided into 4 groups, each being responsible for the daily activities of two meetings. The layout was such that each topic would have a stationary, mostly writing activity as well as a motor skills activity, such as a game or a song in which the students were allowed to move around.

**Struggle and Corruption in “Espuma y nada más” by Hernando Téllez -  
Stefanie Erdman and Dr. June Laval**

**Department of Foreign Languages**

In the work “Espuma y nada más”, the Columbian writer Hernando Téllez illustrates the relationship between a dominating political boss (cacique) and a rebellious townsman, as seen in the informal institution of caciquism in Latin American society. By examining the historical context of the work, I will study this institution and the consequences of rebellion against injustice in early twentieth century Latin America. Through a profound dialog, the characters confront each other in a dual of loyalty and strength. The tragedy of this confrontation poses the question: Is it possible for the rebels to overcome the dominance of the cacique figure? The rebel is also a barber who must struggle between its every day obligations and its loyalty to the rebel cause. In the end he chooses loyalty to his daily means of survival over his loyalty to the cause. Unfortunately, either way he loses. He has saved his life but has compromised his beliefs in exchange for survival.

**Caciquism in “Un día de éstos” by Gabriel García Márquez - Yarisbeth Flores and Dr. June Laval**

**Department of Foreign Languages**

García Márquez, notable “boom” author of the 1960’s, has gained international attention not only for his works, but for his political opinions. One of his most chilling short stories, “One of These Days” (“Un día de éstos”), expresses the abuse of power and corruption existing today in the Latin American system of caciquism. I will examine this typical and common type of political rule in Latin America in history as well as in the story by García Márquez. He omits the use of magical realism in this tale of government abuse, substituting instead a stark, realistic approach. García Márquez turns an ordinary illness into a statement against the oppressive rule of caciquism. In a style that obscures none of the reality and denies any misplaced illusion, the author transforms the extraction of a tooth into a metaphorical treatise against repressive power.

## Rubén Darío: Political Criticism in Two Poems - *Nermin Gupe and Dr. June Laval*

### Department of Foreign Languages

Far removed from the exquisite language of Rubén Darío's modernista poetry and the images of princesses, swans, lily pads, and the "fêtes galantes" of Versailles, the poet also wrote political poems such as those critical of the discovery of America and the attitude of the United States toward Latin America.

The Nicaraguan poet wrote the poem "A Colón" in 1892 to mark the four hundredth anniversary of the discovery of America. The poem, however, does not praise Columbus. Instead, it laments the fact the Columbus ever came to the shores of Latin America. At the end of the nineteenth century, Darío looks at Latin America and what he sees are wars and conflicts. There is destruction, tyrants, dictators. Democracy has failed. The countries of Latin America are not united. Darío's vision of Latin America is pessimistic, one of despair. He concludes the poem with a cry to Columbus: "¡Cristóforo Colombo, pobre almirante, ruega a Dios por el mundo que descubriste!"

In another poem "A Roosevelt", Darío is critical of Theodore Roosevelt: "el riflero terrible y el fuerte cazador", as well as the politics of the United States at that time. His tone is confrontational and aggressive. He directs an accusation to the United States:

"Eres los Estados Unidos,  
eres el futuro invasor  
de la América ingénua que tiene sange indígena..."

The first edition of this poem was published in the collection *De cantos de vida y esperanza* in 1905. A question must be explored: Has the view of the United States toward Latin America changed in the last one hundred years?

**José Martí and His Struggle for Cuban Freedom - *LeeAnn Matthews and Dr. June Laval***

**Department of Foreign Languages**

Far removed from the exquisite language of Rubén Darío's modernista poetry and the images of princesses, swans, lily pads, and the "fêtes galantes" of Versailles, the poet also wrote political poems such as those critical of the discovery of America and the attitude of the United States toward Latin America.

The Cuban patriot, José Martí, dedicated his life to two causes: literature and liberty. At seventeen he was accused of disloyalty to the colonial government and condemned to hard labor in prison. Later he was exiled to Spain where he lived and studied from 1871 to 1874. When he returned to Cuba, he was deported a year later for revolutionary activities. In 1881 he settled in New York, where he wrote many of his literary works. He admired the United States and spoke English fluently. He is remembered for his contributions to the "modernismo" movement and above all for his struggle for Cuban freedom. He died in 1892 fighting against Spanish troops in Cuba. Unfortunately he did not live to see his dream of Cuban freedom from Spain in 1898. I will study the ideals of this Cuban patriot admired by the Cuban people both before and after Fidel Castro.

Two poems from the collection *Flores del destierro* express the love for his homeland. In the poem "Dos patrias" he writes: "Dos patrias tengo yo: Cuba y la noche". In another poem "Domingo triste" the poet expresses his homesickness for Cuba when he sees a sea gull flying toward Cuba. :

"Y es ¡oh mar! la gaviota pasajera  
que rumbo a Cuba va sobre tus olas!"

Martí's greatest popular legacy is perhaps the poetry of "Versos sencillos", where he remembers his life:

"Yo soy un hombre sincero  
de dónde crece la palma  
y antes de morirme quiero  
echar mis versos del alma".

These verses were written the year before his death and were used as lyrics for the modern song *Guantanamera*.

**Explosion and Implosion: Geography, Population, and Urban Growth in Seoul, Korea - *Ansley Freeman, Joseph Williams, Abraham Owen and Dr. Harry Trendell***

**Department of Geography and Anthropology**

This project examines the relationship between geography, population and urban growth in Seoul, Korea from 1989 to 2001. The project is based on two hypotheses. The first hypothesis predicted that the geographic setting of Seoul, Korea would impact both population and urban growth. Map analysis of Geographic Information Systems (GIS) classification data of Seoul in 1989 and 2001 confirmed that urban growth was largely patterned based on the geographic setting of the city. For example, Seoul's urban growth continues to follow natural boundaries, such as mountains and rivers. The second hypothesis predicted that urban growth and population growth would correlate positively. However, the data proved this not to be the case when in actuality, the population of Seoul, Korea decreased between 1989 and 2001, despite the fact that urban sprawl consumed more land. This phenomena is due to a population implosion, whereby the birth rate is lower than the death rate. This project seeks to show these trends using remote sensing data to generate computer maps which demonstrated both demographic and geographic variability.



**Proximity of high tension electrical towers to single-family, residential homes in Cobb County, Georgia: A GIS Approach - *Josephine Moore, Shannon Rogers and Dr. Nancy Hoalst-Pullen***

**Department of Geography and Anthropology**

Concern over health and environmental effects of electro-magnetic radiation has heightened in recent decades. Studies originating in the 1970s support hypotheses that prolonged exposure of residential sources of elevated electro-magnetic field (EMF) radiation correlate with increased likelihood of certain diseases. In the original study, Wertheimer and Leeper (1979) studied a Colorado community with high incidences of cancers and discovered a positive correlation between children living near high-tension towers and increased incidences of childhood leukemia. From the study, Wertheimer-Leeper wire codes were created to define zones for exposure levels. Codes dictate that Class 1 wires include thick, above ground wires in configurations of 6 or more. Class 2 cables are smaller below-ground configurations and small towers. VHCC (Very High Current Configuration) includes Class 1 cables within 50 ft of a residence or Class 2 cables within 25 feet. OHCC (Ordinary High Configuration Current) includes Class 1 cables within 50+ to 130 feet of a residence or Class 2 cables within 25+ to 50 feet. Despite growing numbers of EMF generating devices and diagnoses of cancer and autoimmune disease, as well as the World Health Organization's (WHO) acknowledging the risks of EMF radiation, the Environmental Protection Agency (EPA) and US federal agencies claim residential sources of EMF are not harmful. However, residential properties within exposed locations have declined in value and appeal in the United States. Increased public knowledge and aesthetic drawbacks lower home values in affected areas. The intent of this research is to evaluate a sample of high tension electrical towers, their proximity to single-family residences located within Cobb County, Georgia

**Geocaching on KSU campus: A new GPS learning technique - *Alicia Newberry, Robbie D'costa, Dana Gravedoni, Emily Kimani, Trent Legg and Dr. Nancy Hoalst-Pullen***

**Department of Geography and Anthropology**

Started in 2000, geocaching (geo = geography, and caching = the process of hiding or storing something) is a popular recreational pastime that utilizes Global Positioning System (GPS) technology. Geocaching participants use GPS devices and spatial coordinates to locate caches. Caches vary, but normally participants can take something, leave something, and record their geocaching finds at the cache or online. Some caches involve intricate clues, time factors, or hard to reach locations, such as underwater caches. We believe that geocaching can be a fun and relatively easy way to learn some fundamental aspects of GPS, geographical information systems (GIS), and geography. For that reason, we created a lab for the Kennesaw State University (KSU) students currently enrolled in the Introduction to Cartography class. The lab begins by introducing the history and background of geocaching as well as the basics of using a GPS unit. Second, the lab requires students to find and record waypoints on a GPS unit across the KSU campus based on their spatial coordinates and the clues given to them. Third, students are asked to return to the computer lab to input the waypoints into a GIS mapping program. Students obtain a TerraServer orthophoto of Kennesaw State University's campus and input both the GPS data and the orthophoto into ArcMap. Finally, students use a compass and a paper map to determine the direction of a visible pattern on the orthophoto created from the GPS waypoints. This entire process is laid out in a detailed step-by-step format for the students to follow and can be completed during a 3 hour class period. This lab was successfully completed by Cartography students on April 9, 2007.

## **A Geographic Analysis of Disc Golf Courses in Metro Atlanta and Northwest Georgia – *Shoe Scheuer and Dr. Nancy Hoalst-Pullen***

### **Department of Geography and Anthropology**

Disc golf is a rather unknown sport played with similar rules as those of traditional ball golf. Instead of hitting a ball with a club, disc golfers throw a frisbee-like disc into a metal basket in the least amount of throws. Disc golf can be played by all age groups and is a fun and low cost sport for individuals, groups, and families. Unlike traditional golf courses, disc golf courses are conformed to the natural layout of the land and therefore make installation with minimal alterations to the landscape plausible

(<http://www.pdga.org/makecrse.php>). The goals of the presentation are to increase the level of recognition of this sport, to illustrate the benefits of the game, and to determine the known geographic locations of disc golf courses in the Metro Atlanta area. This presentation will implement a geographic information system (GIS) to display all of the courses in the Metro Atlanta area. In addition the three courses nearest to KSU will be mapped out using a Global Positioning System (GPS). The results will provide multiple maps depicting the entire course layouts of East Roswell Park, Oregon Park, and Sequoyah Park.

**Geographical Analysis of Designated Smoking Areas on the Kennesaw State University Campus - Stacy Ventresca, Phil Reed and Dr. Nancy Hoalst-Pullen**

**Department of Geography and Anthropology**

According to the American Lung Association and the Environmental Protection Agency, nonsmokers exposed to secondhand smoke are at an increased risk for adverse health effects, including cancer, lung disease and heart disease. The Surgeon General's most recent report (2006) states that "scientific evidence [shows] that there is no risk free level of exposure to secondhand cigarette smoke." Even short-term exposure to cigarette smoke can lead to lung disease, currently the third cause of death in the U.S. ([www.lungusa.org](http://www.lungusa.org), 2007). In this study, we performed a spatial analysis to determine the geographical locations of designated smoking areas on Kennesaw State University's main campus. The rationale for this study is to assess the potential exposure of second hand smoke from the established smoking areas on campus. The location of each smoking area was collected using a handheld Garmin GPS unit, and that data was imported into a geographic information system (GIS) as point and line features. We examined each smoking area in relation to the exits and entrances of university buildings. Using ArcGIS, spatial analysis was used to determine if these areas are far enough away from the doors so that contact with secondhand smoke is minimal. A 30m buffer for analysis was used based on an average distance other cities use in public smoking policies in different cities. Currently, Georgia's Smokefree Air Act (2005) does not specifically define a distance for designated smoking areas other than "a reasonable distance". Our findings suggest that the designated smoking areas on campus were not planned and placed with the walking paths in mind, resulting in non-smokers walking through smoking areas to get from one building to another.

**Emergency Centers: A Closer Look at Existing ER Centers in Cobb County**  
**- Joseph Yankah, Dr. Mark Patterson and Dr. Harry Trendell**

**Department of Geography and Anthropology**

Getting to the Emergency Room (ER) in time can be a very stressful and traumatic event, especially in terms of ER accessibility and the nature of the emergency situation. Each year more than 500,000 Americans die unnecessarily because they do not get to the ER soon enough to properly treat their medical problems. In most cases, delay can be deadly especially, with cardiovascular disease (CVD) where the State of Georgia has the sixth highest CVD death rate in the nation. It is hypothesized that spatial analyze of the existing Emergency Medical Services within Cobb County Georgia will indicate ways to improve the efficiency and effectiveness of the delivery of ER services. This project be used Geographic Information Systems (GIS) technology to identify, locate, and study the spatial pattern of existing ER locations and their respective proximity to other services (including accessibility). An assessment was made of spatial demographic variables including sex, race, age and household income distribution within the county's census tracts. A base map of the Cobb County census tracts was downloaded from data sets provided by Census 2000 Tiger/Line files and population distribution data was downloaded from <http://www.esri.com/> and <http://www.census.gov/>. Existing ER locations were geocoded onto the base map and used to create a buffer intersect layer using population data and existing ER locations as a new feature class. The results from the project revealed population distribution by attributes of people who benefit from the existing ER locations. The data will help the county's Zoning and Planning Department to provide improved services to residents of Cobb and provide locational information regarding a proposal for a new ER to be built to county's growing population.

## **ADHD in Children: An Investigation of ADHD Prevalence in a Pediatrics Practice - *Stephanie Pospishil and Dr. Christine Ziegler***

### **Department of Psychology**

The prevalence of attention deficit hyperactivity disorder (ADHD) in a pediatrics medical office was examined. Archival data were obtained from patient appointment records. The number of well visits and ADHD visits were recorded on a standardized data collection sheet. Demographic information confined to the simple notation of sex and age was also recorded on the standard data sheet. The data were organized using the statistical program SPSS. It was found that the prevalence of ADHD was not significantly higher in the pediatrics practice (2.9%) than national and regional figures. Prevention of grade retention, low academic achievement, and other risk factors such as low socioeconomic status (SES) that may contribute to the development of ADHD were discussed.

## College of Science and Mathematics

### **Ecoregion Differences in Lipid Content of *Campostoma oligolepis* - Michelle Beattie and Dr. William Ensign**

#### **Department of Biology and Physics**

The ecoregion concept provides a framework for organizing ecosystem resource information (Omernik, 1987). Examination of organismal attributes within a single watershed that spans more than one ecoregion may allow identification of environmental factors that influence organismal condition. To test this idea, we compared lipid composition of an herbivorous minnow, *Campostoma oligolepis* (largescale stoneroller), from six sites within the lower Etowah River basin. Half of the sites were located within the Piedmont ecoregion where dissolved ion content is low and half were located in the Ridge and Valley ecoregion where dissolved ion content is relatively high. Since ion content is related to algal productivity, we expected to see differences in lipid content of stonerollers between the two ecoregions. Between 10 and 20 stonerollers were collected from each of the study sites and processed in lab. Each fish was measured to length, viscera removed and the remaining tissue homogenized. Lipids were extracted using a modification of the Bligh and Dyer method, dried for 48 hours and weighed on an analytical balance. A second sample was also drawn from the homogenate, dried and weighed, allowing estimation of percent composition. Our results indicate that lipid content of Age 1 individuals was higher than that of Age 2+ individuals. Contrary to our expectations, lipid content of stonerollers in Piedmont streams was higher than that of stonerollers in Ridge and Valley streams.

**Distribution of *Gymnopodium floribundum*: A Closer Look - *Flavia Bitussi*  
and *Dr. Paula Jackson***

**Department of Biology and Physics**

This study took place in Dzibilchaltun in the Yucatan peninsula of Mexico, an area dominated by tropical dry forests. As a result of both climate and thousands of years of slashing and burning, the area is characterized by a rough terrain, with extremely thin and arid soil, and scattered with thorny trees, shrubs, vines and cacti. *Gymnopodium floribundum* (family *Poligonaceae*), one of the prevalent evergreen trees in the area, presents a strong clumped distribution. Within the species, trees either have multiple stems originating from the same area at the ground, or individual trees grow in close proximity to each other. These observations led to the hypothesis that *G. floribundum* may be a clonal species. The objectives for this study were: to search for morphological evidence of clonality in this species, map patterns of distribution of potential genets, and collect leaf samples for DNA analyses. Starting at the center of a potential genet, an area of 355m<sup>2</sup> was sampled. Within this area, all tree stems were labeled and counted, all stem circumferences were measured, and leaf samples were collected. Morphological data (e.g. the presence of rhizomes) supported the hypothesis of facultative clonality in *Gymnopodium*. With the data collected in the 355m<sup>2</sup> a map was built, which will be used to associate to results of leaf DNA, and determine the extent of potential genets. The data collected in this study will serve as a basis for further research to look into the life history strategies of the species *Gymnopodium floribundum*.



**Quantification of Phytochelatins in *Ceratopteris richardii* Using Tris-Tricine SDS-PAGE and HPLC - Deborah Gaddis, Saman Nematbakhsh, Dr. Dale Vogelien<sup>1</sup> and Dr. Jennifer Powers<sup>2</sup>**

**Department of Biology and Physics<sup>1</sup> and Department of Chemistry and Biochemistry<sup>2</sup>**

Phytochelatins (PCs) are a class of metal binding peptides synthesized enzymatically from glutathione (GSH). Because they are produced in plants upon exposure to heavy metal stress, they are recognized as a possible mechanism for heavy metal detoxification in plants. The purpose of this study was twofold: 1) to compare a conventional HPLC method for PC quantification and a relatively new electrophoretic method; and 2) to quantify PCs in the wild type strain of *Ceratopteris richardii* upon exposure to increasing cadmium (Cd) stress. A linear relationship between standard amount and signal was obtained for GSH and PC2-4 by both reverse phase chromatography and Tris-Tricine SDS-PAGE. The HPLC method was 10-fold more sensitive, allowing a detection as low as 0.1 nanomole GSH or PC2-4. The electrophoretic method required optimization in order to resolve PC3 from PC2 and PC4. A gel composition of 12.5%T, 6%C, and 6M urea was empirically determined to provide the best resolution of these standards. GSH and PC2-4 levels were then quantified in extracts of gametophytes that had been exposed to 0, 12.5 (sublethal), and 100 (lethal)  $\mu\text{M}$   $\text{CdCl}_2$  for 72 hours. HPLC data indicate that unstressed and stressed gametophytes contain similar levels of GSH, the building block for PC biosynthesis. In addition, chromatograms of control extracts indicated the presence of relatively low levels of PC3, suggesting that gametophytes not experiencing metal stress produce this PC. Chromatograms of sub-lethal exposed tissue extracts indicated the presence of PC2 and PC3 (with an approximate 1.5 fold higher level of total PCs than that found in control extracts), while those of lethal exposed extracts indicate the presence of PC2-4 (with an approximate 3-fold increase in total PCs over that of sub-lethal exposed tissue extracts). Thus, exposure to increasing levels of Cd stress appears to be correlated with an increase in total PC content as well as the appearance of a larger PC with higher metal binding capacity.

## **Changes in nutrient content of Georgia peanut infected with *Aspergillus flavus*, a carcinogenic mold – Gustavo Galdo and Dr. Premila Achar**

### **Department of Biology and Physics**

*Aspergillus flavus* is one of the fungal species known to produce aflatoxin and is a common contaminant in peanut. *Aspergillus flavus* can invade peanuts in the field before harvest, or poor storage can lead to infection by the mould, releasing carcinogenic aflatoxins. A thorough understanding of the host-pathogen interaction between peanuts and *A. flavus* may provide information to develop novel detection and screening methods for peanuts. In spite of strict control measures against *Aspergillus* species, the peanut industry in Georgia is still facing economic loss due to contamination by this mold. Host-pathogen interaction leads to biochemical changes and reduction in the nutrient value of peanuts. *A. flavus* is known to depend on the protein and starch content of the peanut causing changes in the related enzyme activities. Present study investigate the changes in protein, starch, amylase, and protease content in peanuts following infection by *A. flavus*. Peanuts were obtained from commercial outlets in Kennesaw. Protein was estimated by Bradford method ( BioRad) and absorbance was measured at 595nm. Bovine Serum (BSA) was used as the protein standard for the calibration curve. Results revealed that changes in protein, starch, and amylase content when comparing infected samples than uninfected samples. Changes may be attributed to the host response to infection or contribution by the fungus. Moreover, the changes may also be due to biochemical changes that occur naturally during the transition from endosperm to seedling as the plant grows.

**Genetic structure and parentage analysis of the marbled salamander,  
*Ambystoma opacum*, in Marshall Forest, Rome, GA - Nicole Gray and  
Dr. Thomas McElroy**

**Department of Biology and Physics**

There are many factors involved in the unprecedented worldwide decline of amphibian populations. The most obvious factors are habitat destruction and alterations such as clear cutting and draining of wetlands. Other factors include disease, global environmental change, as well as contaminants. Amphibians are a good indicator species for assessing environmental quality. They are characterized by permeable skin and a biphasic life-cycle, which makes them sensitive to environmental disturbance. One method for determining the overall diversity and population health in amphibians is to monitor their breeding sites. Since December of 2003 we have monitored a vernal pond in Marshall Forest which serves as a breeding site for many amphibians, including the marbled salamander. Adult male and female salamanders were captured as they entered the pond in the fall. The juveniles were captured as they left in late spring. Captured individuals were measured, weighed and photographed. A one centimeter portion of the tail was kept for genetic analysis. The salamanders were then released. We surveyed 5 polymorphic microsatellite loci in each individual. The amplified products were electrophoresed on an ABI 310 automated DNA sequencer. Parentage analysis and population genetic structure indicted a general skew in reproduction for this population. This may be the result of selection on life history characters or other aspects of the salamander's reproductive biology; however, genetic drift could not be excluded.

**Using Bacterial Artificial Chromosome (BAC) to Characterize the  
Breakpoints of the Pericentric Inversion - *Vanessa Jordan and Dr.  
Xueya Hauge***

**Department of Biology and Physics**

Pericentric inversions of human chromosomes occur in ~1% of the general population. An inversion is caused by two breaks in both long and short arms, and the disconnected segment between these 2 breaks flips 180° and reunites with the remains of the 2 arms. A pericentric inversion of a chromosome will lead to the formation of an inversion loop in meiosis. If a cross over occurs within the inversion loop, it will result in a duplication of a chromosomal segment and deletion of another segment. Such chromosomal imbalances will lead to clinical consequences such as infertility and stillbirth. We used 2 bacterial artificial chromosome clones, RP11-250O17 and RP11-79A9, and fluorescent *in situ* hybridization (FISH) to map the breakpoints in an inverted chromosome 9. BAC clones were identified through a genome database search, and the BAC DNA was isolated and purified using the Qiagen Midiprep method. DNA probes were labeled with either SpectrumGreen or SpectrumOrange and then hybridized to the metaphase chromosomes prepared from an individual with an inversion of chromosome 9. Chromosomes prepared from normal individuals were used as controls. Two fluorescent signals were observed on chromosome 9 after the hybridization of these probes to the metaphase chromosomes, indicating that these probes contain the centromeric repetitive sequences. In normal controls, one signal is seen at the centromere of chromosome 9 and the second signal is seen on the long arm of chromosome 9. In the inverted chromosome 9, however, the signal on the long arm is moved to the short arm, indicating that an inversion occurred and the breakpoint on the long arm of chromosome 9 is distal to the BAC probes used in FISH. Further directions of this project include carrying out FISH experiments with probes that are more proximal to the breakpoints on the inverted chromosome 9. (Supported by Incentive Grant and SALT programs)

**Preliminary study of the physiology of three tree species in Dzibilchaltun,  
Yucatan Peninsula, Mexico - Lisa Meeks and Dr. Paula Jackson**

**Department of Biology and Physics**

This study was conducted in the dry deciduous forest of Dzibilchaltun, Yucatan, Mexico. The arid climate of this type of forest requires a variety of adaptive physiological responses by trees, the extent of which has yet to be thoroughly understood. The objective of this study was to collect physiological data for three tree species that differ in their leaf flushing pattern and dominate the dry forest of Dzibilchaltun. The species studied were *Gymnopodium floribundum*, *Diospyros cuneata* (both evergreen), and *Piscidia piscipula* (a brevi-deciduous species). The study took place at the height of the dry season, May 2006. Data were collected for one leaf per individual and three individuals per species using a Heinz-Walz GmbH MINI-PAM Photosynthesis Yield Analyzer. Pre-dawn and midday water potentials were collected using a Scholander-type pressure chamber. Light saturation curves indicate that *P. piscipula* (brevi-deciduous) maintained higher average apparent electron transport rates, light saturation points and water potentials, and a lower average NPQ (heat dissipation) value as compared to the evergreen species (*D. cuneata* and *G. floribundum*). Comparisons of *D. cuneata* and *G. floribundum* (evergreen) revealed that *D. cuneata* maintained a lower average electron transport rate, light saturation point, and NPQ; and a higher average water potential as compared to *G. floribundum*. We found high variability in apparent electron transport rate between individuals of *G. floribundum*, and all water potential measurements for this species were beyond the scale of the pressure chamber. Our data suggest potential differences in the physiological response to drought of these three species.

**Toxicity of  $\text{Al}_{13}^{7+}$  as compared with  $\text{Al}^{3+}$  to agricultural and wetland plants -  
Kalisa Phifer, Dr. Heather Sutton<sup>1</sup> and Dr. Marina Koether<sup>2</sup>**

**Department of Biology and Physics<sup>1</sup> and Department of Chemistry and Biochemistry<sup>2</sup>**

Alum (Aluminum Sulfate) is used in the water treatment process to coagulate small particles in the water so they can settle out and be removed. At the end of the treatment process, the filtered sediment is separated and compressed with lime into "cakes" that are given to farmers to spread on their fields. The aluminum in these "cakes" is then able to enter the environment by leaching into the soil and as runoff into streams and aquatic systems. Traditionally, water treatment facilities have used alum containing  $\text{Al}^{3+}$ , but some facilities in northern states have begun using  $\text{Al}_{13}^{7+}$ , which is more effective under some conditions.

This project focuses on aluminum toxicity in agricultural and wetland plants. To determine whether there was a difference in toxicity between  $\text{Al}^{3+}$  and  $\text{Al}_{13}^{7+}$ , *Asclepias incarnata* (swamp milkweed), *Lactuca sativa* (lettuce), and *Raphanus sativus* (radish) seeds were germinated, and then grown in the two species of aluminum. Radish tests were conducted under conditions of differing pH. After a growth period, root and shoot growth and mass was measured. Following acid digestion, concentration of aluminum, (as well as some other elements in radish tests), in the plants was determined. Tests were also conducted on *Lemna gibba* (duckweed) under conditions of differing pH. Frond counts were used to determine toxicity.

Results showed that lettuce and *Lemna* had more consistent responses to the aluminum than the radish or swamp milkweed. Where toxicity was seen, the  $\text{Al}_{13}^{7+}$  was almost always the most toxic of the two aluminum species.

**Analysis of fungal community diversity associated with dominant tree species from the Yucatan Peninsula, Mexico - *Ariel Smith, Dr. Thomas McElroy and Dr. Paula Jackson***

**Department of Biology and Physics**

The rapid urbanization in Mexico poses a potential threat to the dry tropical deciduous forest of the Yucatan Peninsula; thus, it is essential to protect the availability of fresh water in that area. However, there is a lack of knowledge on how these dry tropical trees obtain their water sources. Local tree species distributions may be driven by microbial associations that affect their ability to use ground water and soil nutrient pool resources. Therefore, it is important to understand the relationships between co-occurring plant species and associated microbes. To identify underground root tissue this study created a DNA sequence database (chloroplast trnL (UAA) intron) for some tree species from the Yucatan Peninsula, Mexico. To identify associated microbial communities Terminal Restriction Fragment Length Polymorphism (TRFLP), a culture independent method, was used to analyze the microbial communities. Root and soil samples were collected from the field site.. Whole genomic DNA was extracted from the tissue and associated soil samples. The trnL intron of the plant genome was amplified and sequenced. The DNA sequence was compared to the local database for identification. The ITS region of the fungal genome was subjected to PCR amplification with fluorescently labeled primers. The amplicons were cut with Taq1 endonuclease restriction enzyme and the fragments were analyzed with an ABI 310 Genetic Analyzer. Differences in microbial community composition associated with different tree species will be discussed.

**Genetic characterization of the stone roller (*Campostoma oligolepis*) in the Etowah River system - Deserah Strand, Dr. Thomas McElroy and Dr. William Ensign**

**Department of Biology and Physics**

*Campostoma oligolepis*, the common stoneroller found in the Etowah River ecosystem, is an abundant species which can be used to assess the conservation implications of severing the connectivity of a water system that is home to many species. We have examined the variability at several highly variable genetic loci (STR, microsatellites) among 6 populations of *C. oligolepis*. We have combined these data with hydrologic and ecological data collected from study sites to describe population dynamics and analyze the spatial genetic structure. Our work has a direct impact on 1) the understanding of fish movement and gene flow in the Etowah River ecosystem for which there is currently very little information; 2) delineation of the impacts of natural and artificial barriers to fish movement and spatial genetic structure; 3) the ability to link hydrology and ecological dynamics to identify potential driving forces behind spatial arrangements of genetic variation. We tested the following hypotheses: 1) populations above and below Allatoona Dam are genetically distinct, (2) anthropogenic change strongly influences population dynamics and genetic structure causing the magnitude of genetic difference between pairs of sites to be related to hydrological disturbance patterns rather than the geographic river distance separating them; however, in regions where the river is relatively undisturbed genetic differences will be driven primarily by isolation by distance (IBD). Our data suggests that the populations above and below Allatoona Dam are genetically distinct. Further, anthropogenic disturbance significantly impacted connectivity among sites.



## **Molecular relatedness in *Aspergillus flavus*, a carcinogenic mold affecting Georgia peanut – Deaton Thomas and Dr. Premila Achar**

### **Department of Biology and Physics**

*Aspergillus flavus* can invade peanuts in the field before harvest, during harvest, in storage and transportation. Aflatoxins are secondary metabolites produced by *Aspergillus* species and are carcinogenic in humans. Several strains of *A. flavus* exists in peanut growing areas in Georgia, however, their virulence varies with geographical distribution. A number of molecular techniques are currently available for studying genetic relationships between fungal populations. In the present study we used polymerase chain reaction (PCR) to establish genetic diversity among isolates of *A. flavus* from peanut growing areas in Georgia. For cultural characterization, isolates were transferred onto PDA plates and incubated at 30°C. After 7 days of incubation, based on morphology and colony character, potential colonies were screened for *A. flavus*. Monoconidial colonies were checked under stereomicroscope, then transferred onto PDA plates and incubated at 25°C in the dark. All strains were stored on either PDA slants or Petri dishes. Fungal DNA was isolated using standard protocol with slight modification whenever necessary. PCR amplification of genomic DNA was performed using universal (ITS) 1 and (ITS) 4 primers. PCR amplification of ribosomal DNA for *A. flavus* revealed one common band of approximately 600 bp for all the isolates, although 2 of the isolates showed a slight variation. This variation appeared only in the toxigenic forms of *A. flavus* used in this study. Restriction digestion of PCR products with specific enzymes and sequencing of the same may give additional information of the molecular relatedness of different isolates, the toxic and the non-toxic forms of *A. flavus* in Georgia peanuts.

**A First Look at the Physiology of *Cypripedium acaule* (pink lady's slipper)  
compared to two other understory species - Jackie Waier and Dr.  
Paula Jackson**

**Department of Biology and Physics**

Pink lady's slippers are rare orchids, emerging 10 – 20 times in their ~100 year lifespan. Few studies have looked at the physiology of this species across a growing season. This study took place in the understory of a mixed pine hardwood forest on the Kennesaw State University campus from mid-April through late-June 2006. Diurnal and seasonal changes in maximum photosynthetic rates and light saturation points (measured using a LiCOR 6400 gas exchange system) of the pink lady's slipper were examined. Late in the season, the values obtained for the lady slipper were compared to wild ginger (*Asarum canadense*) and an oak sapling (*Quercus sp.*) growing in a similar environment. Data indicated diurnal and seasonal differences in maximum photosynthetic rates and light saturation points for the pink lady's slipper; with the highest light saturation point and photosynthetic rate found in the early season, and progressively declining throughout the season. Measurements for wild ginger and the oak sapling were taken in June. Compared to these species on the same day, the pink lady's slipper had the lowest photosynthetic rates, followed, in increasing order, by the wild ginger, and the oak, which had the highest rates (Pink Lady: 1.5; wild ginger: 4.02; oak: 4.43  $\mu\text{mol m}^{-2}\text{s}^{-1}$ ). However, when comparing maximum photosynthetic rates across season (independent of date or time of day), all species had similar maximum rates (oak: 4.43, Pink Lady: 4.36, Wild Ginger: 4.02  $\mu\text{mol m}^{-2}\text{s}^{-1}$ ). To manage the pink lady's slipper populations effectively an understanding of its physiology is necessary.

**Rapid and sensitive method to detect carcinogenic mold, *Aspergillus flavus*, in Georgia peanuts – Julia Wand and Dr. Premila Achar**

**Department of Biology and Physics**

*Aspergillus flavus*, a fungal mold, is a common contaminant of peanuts. *A. flavus* produces aflatoxins which are known to be both carcinogenic and highly toxic, threatening humans, livestock and crops. While the US already has in place regulations to monitor aflatoxin contamination levels, many poor nations either do not have or fail to comply with regulations resulting in aflatoxins making it to market. While many techniques for fungal detection exist, it is important to find quick and accurate methods that yield readable results. In this study, we compared PCR and RAPD to detect *A. flavus* in contaminated peanuts from Georgia. Peanuts from supermarkets were plated on potato dextrose agar and incubated at 30°C. After 7 days of incubation, based on morphology and colony character, potential colonies were screened for *A. flavus* and confirmed by PCR and RAPD. Fungal DNA was isolated using standard method. Ribosomal DNA (rDNA) was amplified using polymerase chain reaction with the universal primers, internal transcribed spacer (ITS) 1 and (ITS) 4. For RAPD reactions, UBC primers 226, 245 and 300 were used. PCR results showed that ITS amplicons for *A. flavus* ranged from 600 to 650 bp. We predicted that the RAPD results of ITS region of *A. flavus*, would be consistent with those of PCR, however, the sequences amplified in RAPD were random and thus lacked the specificity and sensitivity of PCR. Furthermore, a large amount of DNA fragments were required for RAPD compared to PCR.

**Which Carrots Do You Buy? A Comparison of Conventional and Organic Carrots - *Razi Abbas, Iniobong Ekpo, Kevin Ashley and Dr. Marina Koether***

**Department of Chemistry and Biochemistry**

Organic and conventional baby carrots were compared for weight, length, thickness and metal content. Results indicate an appreciable difference in appearance but limited difference in Pb, Cr, Cu, Cd, Zn and Ni content. Both wet and dry weights were recorded indicating a 90% water content in the carrots. Tabular results will be presented.

**Burning Down the House: Solving a Mock Arson Case - Razi Abbas, Lauren McAdams, Paul Muchene and Dr. Christopher Dockery**

**Department of Chemistry and Biochemistry**

The US National Fire Protection Agency reports approximately 1.8 million fires occur annually, and estimate that one in four fires are a result of arsonists. Therefore, the forensic investigator is often asked to analyze suspected arson samples. Arsonists often assume that the accelerant used to start the fire will be consumed during the course of the fire, but this is rarely the case. Careful analysis of the fire debris leaves telltale signs of burned and unburned hydrocarbons originating from commercial accelerants. In this project, we sample vapors produced by the volatile components of the accelerants and compare the chromatographic data from several commercially available accelerants to determine the source accelerant in simulated arson investigation.

**What's in your bottled water? Study of metal ions in bottled water - *Razi Abbas, Iniobong Ekpo, Kevin Ashley and Dr. Marina Koether***

**Department of Chemistry and Biochemistry**

Thirty-six bottled water samples representing water from around the world were analyzed for metal content by using flame atomic absorption spectroscopy. Preliminary results for Ca, Na, Mg, K, Pb, Cr, Cu, Cd, Zn, Al, and Ni will be highlighted. Specific samples will be highlighted with respect to source, water treatment method and listed contents. While some bottled water samples list zero mg Na per serving, results indicated that Na was present in the water sample.

**The Rubber Ducky Witness: Cracking the Case of the Bathtub Drowning -  
*Holly Adams, Megan Langgood, Danae Stiles and Dr. Christopher  
Dockery***

**Department of Chemistry and Biochemistry**

You have seen it dozens of times on TV: a victim is found drowned in a lake, pool, bathtub, etc and the forensic investigator takes the case. But all is not as it seems... The water in the victim's lungs clearly does not match the water in the lake. (Pause for dramatic music) Where was the victim drowned? Who are the suspects? Perhaps the victim was drowned in a bathtub and later dumped into the river. Using modern chemical instrumentation including High-Performance Liquid Chromatography and Capillary Electrophoresis, we attempt to determine if water from a mock drowning case can be definitively linked to a point of origin in this exciting installment of The Case of the Rubber Ducky Witness.

## **Exploring the chemistry of N-confused tetraphenylporphyrin - *Michael East and Dr. Janet Shaw***

### **Department of Chemistry and Biochemistry**

The biological macrocycle, porphyrin, is ubiquitous in all life forms where it plays a significant role in oxygen transport and oxidation and reduction reactions. Metals ligated to the porphyrin core assist in these natural processes. Porphyrin is also very commonly used in laboratory practices as a model system for natural processes and in the field of medicine where it most notably functions as an anticancer therapeutic in photodynamic therapy.

Recently, an efficient synthesis for a structural isomer of the popular molecule, tetraphenylporphyrin (TPP), has been established. The isomer, N-confused tetraphenylporphyrin (NCTPP), differs from the parent molecule in a single pyrrole inversion exposing one of the internal nitrogen atoms to the periphery. NCTPP retains the significant properties of the porphyrin macrocycle while its subtle differences open an entire field of new opportunities.

In this research NCTPP and TPP were synthesized and characterized. The successful synthesis of both molecules was determined by H-NMR analysis and UV-Vis analysis was used as a basis of comparison for the possible use of the N-confused porphyrin macrocycle in photodynamic therapy. The results suggest that the N-confused porphyrin macrocycle has distinct advantages over the porphyrin macrocycle as it absorbs light at a more useful wavelength given the requirements of photodynamic therapy. The metallated variant, Zn-NCTPP, was successfully synthesized with a 27.64% yield as determined by H-NMR analysis. Attempts were also made to synthesize a heteroatom substituted variant of NCTPP to explore new metal coordination modes, but desired product was not isolated.



## **Identification of a Suspicious Drug Using Gas Chromatography/ Mass Spectroscopy - *Gregory Everhart and Dr. Huggins Msimanga***

### **Department of Chemistry and Biochemistry**

Designer drugs including sage, Crystal, Mushroom2, Cloud 9, Trip2nite and others have become readily available to consumers through the internet. These drugs are acclaimed to produce the same desired effects to the user as scheduled drugs. A quick analysis of such products will educate consumers and provide law enforcement the capability to apprehend misusers. The purpose of this study was to elucidate the chemical composition of a substance called Crystal using gas chromatography/mass spectroscopy (GC/MS). The substance, in tablet form, was purchased through the Department via the internet for analysis. Pulverized tablets were dissolved in various organic solvents to determine which solvent best extracted the volatile chemicals. Different pH media were also investigated since some drugs are either acidic, neutral, or basic. Optimum experimental conditions were noted when a slightly basic methanol or acetonitrile were used as extraction solvents. A distinct large peak appeared at 8.137 minutes, followed by a smaller one at 8.467 minutes. Both peaks contained a benzene ring substituted to piperazine. Molecular ions indicated the larger and smaller peaks to have ionic masses of 190 m/z and 176 m/z respectively.

**Determining A Cost Effective Coagulant Mixture Of Aluminum Sulfate And Polymeric Aluminum Used In Water Treatment - *Dayne Fraser and Dr. Marina Koether***

**Department of Chemistry and Biochemistry**

The most common coagulants used in water treatment are aluminum sulfate (alum) and polymeric aluminum. Polymeric aluminum requires more heat energy to manufacture than alum; as a result there is a 10% increase in cost. Though being more expensive polymeric aluminum is a more effective coagulant. The aim is to find a mixture of alum and polymeric aluminum that is both effective and low cost. Raw water samples were tested with varying temperature, alkalinity, turbidity and ion content. This simulated the various types of raw water sources a treatment plant may experience without adding organic matter as a factor. The coagulant mixtures ranged from 0/100% to 60/40% polymeric aluminum/alum in 20% increments. Under most conditions variations in temperature and ion content will have no significant impact on results. However a direct correlation was found, as turbidity and alkalinity increased the amount of coagulant mixture needed also increased. The most cost effective mixture under most conditions was a mixture of 60% polymeric aluminum and 40 % alum. Also the optimal condition for raw water solutions was that of lowest possible turbidity and alkalinity with little regard for temperature or ion content.

**Pane in the Glass: A Forensic Characterization of Glass Fragments - *Tiffini Menhorn, Sarah Rosenbaum, Matthew Rosenberg and Dr. Christopher Dockery***

**Department of Chemistry and Biochemistry**

Can glass fragments found at the scene of a crime be analyzed and linked to a specific point of origin? Historically, forensic analysis of glass fragments has relied on physical matching of fracture patterns by comparative microscopy. This technique however requires large glass fragments for successful analysis. Other physical characteristics including density and refractive index can produce inconclusive results. In this project, the trace elemental profile of glass fragments was characterized by laser-induced breakdown spectroscopy (LIBS) to generate a "chemical fingerprint". Statistical analysis of the physical data (density and refractive index) in concert with the trace chemical profile provides definitive classification of the selected glass fragments.

**New thiazol functionalized carbenes and its metal complexes - *Clay Owens, Akash Patel and Dr. Daniela Tapu***

**Department of Chemistry and Biochemistry**

Carbene derived metal complexes have been shown to function as catalysts in many organic reactions. Here, we report the synthesis of a novel imidazol-2-ylidene metal complex precursor. The synthesis of the desired imidazolium salt was possible via the reduction of formyl thiazole and the subsequent chlorination of 2-(hydroxymethyl)-thiazole. Methyl-imidazole was then alkylated with the 2-chloromethyl-thiazole to form the imidazolium salt. Imidazolium derived carbenes with a thiazole moiety have yet to be reported. This carbene is expected to be an excellent ligand due to its incorporation of a metallophilic carbene center and thiazole moiety. The imidazolium precursor was successfully characterized for purity and structure by NMR spectroscopy.

**P-Glycoprotein: Role in Cortisol Transport - *Sheel Patel, Monir Clark and Dr. Jennifer Powers***

**Department of Chemistry and Biochemistry**

P-Glycoprotein (Pgp) is an integral membrane protein, expressed in a variety of species and tissues. In humans it is coded for by the MDR1 or MDR2 gene. Both gene products serve as transport proteins, but differ greatly in the variety of compounds they transport. The product of MDR1 can transport a wide variety of compounds such as peptides, xenobiotics, and steroids. Two long-term goals of this project are to determine which specific steroids are transported by Pgp in adrenal cells and if increased production of steroids leads to an increased production of these Pgp transporters. In this study, adrenocortical H295R cells were treated with classical stimulators of steroid hormone production, such as Angiotensin II (All), as well as a classical Pgp inhibitor, verapamil. To identify and quantify steroids effluxed by the cells, HPLC analysis was performed on the cell efflux after treatment. Solid phase extraction using Sep-Pak cartridges was performed to extract the lipophilic compounds effluxed from the cell media. This was followed by concentration using the CentriVap concentrator. This procedure was optimized using known amounts of standard steroids for the highest recovery prior to working with cell samples. HPLC data from cells treated with Angiotensin II for 24, 48, and 72 hrs showed increased cortisol secretion. Other steroids could not be verified due to their low levels or lack of an appropriate standard. It was known that increased levels of All should increase steroid efflux; we suspect that this is due in part to an increase in efflux through Pgp. However, this needs confirmation by experiments in which Pgp function is blocked and by Western blotting to show increases in Pgp levels. Initial attempts at Western blotting were hindered due to interferences with the bicinchoninic acid (BCA) protein assay as well as solubilization issues. Work done here compares results from three different solubilization buffers. Later Western blotting studies were inconclusive since the Pgp seemed to have been cleaved by proteases. Treatment with verapamil, the Pgp inhibitor, showed a decrease in cortisol efflux at 24 and 48 hrs which could indicate that Pgp transports cortisol specifically. However, at 72 hrs there was a slight (5%) increase in cortisol efflux compared to control. This could be due to the efflux of the steroid via passive diffusion rather than through Pgp. Further studies are needed to confirm this.

**Molecular Modeling: Vibrational Mode Analysis of  $\text{H}_5\text{O}_2^+$  and  $\text{H}_7\text{O}_3^+$  -**  
***Fareeha Rizvi and Dr. Martina Kaledin***

**Department of Chemistry and Biochemistry**

This work shows the molecular modeling of water clusters such as  $\text{H}_5\text{O}_2^+$  and  $\text{H}_7\text{O}_3^+$  being analyzed by two methods of ab initio approximations, B3LYP and B3PW91. B3LYP uses two functional; one functional is known as Becker's functional that uses 3 parameters and the other functional is called Lee-Yang-Parr functional. The other method B3PW91 also uses the 3 parameter functional. The calculations on smaller molecules such as hydroxide ion, hydronium ion and water are also performed. The main focus of this research is to analyze the normal modes of water clusters. The normal mode analysis describes the vibrational properties such as frequencies and energies of the molecules. The basis sets pvdz and pvtz are utilized in order to approximate the wave functions of molecules. Literature values are collected and then compared with the experimental values. The presentation's layout includes the brief explanation of theoretical concepts such as variation method, Born-Oppenheimer approximation and normal mode analysis etc. More stress is put on explaining mathematical relationships relevant to computational chemistry and how they are used in describing the normal mode analysis and other quantum chemistry concepts. Thus, the poster will contain many mathematical terms describing the molecule's activities.

## **What's in Your Wallet? Analysis of Cocaine on U.S. Paper Currency -Sarah Rosenbaum and Dr. Christopher Dockery**

### **Department of Chemistry and Biochemistry**

Do you have a \$20 in your pocket? Then there is a good chance that you would test positive for trace amounts of cocaine! It has been suggested that all circulated US paper currency becomes contaminated with detectable amounts of cocaine by contact with previously contaminated bills in financial institutions. The US government reports that an estimated 3.3 million citizens are considered hardcore cocaine users, consuming between 287 and 376 metric tons of cocaine at an annual cost of \$38 billion and providing ample amounts of cocaine to contaminate the money supply. Numerous articles have reported that detectable amounts of cocaine may be extracted from paper currency and analyzed by GC-MS. In this experiment, we will extract cocaine from paper currency using common extraction protocols and determine the concentration of cocaine on different denominations of paper currency acquired from different locations in the Kennesaw area.

**Who shot the Sheriff? Determining the lifetime of detectable amounts of gunshot residue on the hands of a shooter - *Matthew Rosenberg and Dr. Christopher Dockery***

**Department of Chemistry and Biochemistry**

Laser-induced breakdown spectroscopy (LIBS) has been used to determine the period of time that a suspect shooter will test positive for gunshot residues after firing a revolver. Multiple shots of primer were fired through a revolver and samples collected at twelve hour intervals. Samples were collected using an adhesive tape pressed against the skin and analyzed directly using a commercially available laser-induced breakdown spectrometer. Multiple barium lines (originating from the primer material) were observed from the suspect samples and statistical analyses were compared to a library of blank samples to determine a threshold for positive gunshot residue tests. Positive results are obtained up to 6.5 days after a shooting.



**Metal complexes derived from imidazole-2-ylidene - *Carl Saint-Louis and Dr. Daniela Tapu***

**Department of Chemistry and Biochemistry**

The objective of this project is the synthesis and characterization of new carbene derived metal complexes. It was formerly revealed that carbene containing ligands form metal complexes with increased stability and/or catalytic activity. Here, we report the synthesis of a novel imidazole substituted imidazolium salt. This is the precursor to a novel imidazole substituted carbene. This carbene will be utilized as ligand for different metals. It is our prediction that this carbene will function as a strong coordinating ligand to a metal center due to its dual binding mode: a nucleophile carbene and the nitrogen atom of the imidazol moiety. The catalytic activity of the newly synthesized complexes will be also the object of our study.

## **Heavy metal content in organic and conventional produce - *April Stevens and Dr. Marina Koether***

### **Department of Chemistry and Biochemistry**

This study investigated the heavy metal content in carrot seeds and carrot and spinach produce grown organically and conventionally. Specifically lead (Pb), nickel (Ni), copper (Cu), cadmium (Cd), chromium (Cr) and zinc (Zn) content were measured. Carrot seeds ( $>0.1000$  g,  $n=20$ ), Bunny Luv, California Farms, Whole Fields, Cara Bites and Publix carrot sticks ( $>0.1000$  g,  $n=20$ ), Earthbound Farm and Fresh Express spinach leaf ( $>0.1000$  g,  $n=20$ ) samples were digested in concentrated nitric acid for one week, diluted and filtered to 10mL with deionized water and analyzed using Flame Atomic Absorption Spectroscopy (FAAS). There were ~70-seeds/0.1g samples and the average metal content in the carrot seeds were: Pb  $7.9 \pm 0.9$ , Ni  $3.6 \pm 0.5$ , Cu  $9.9 \pm 0.7$ , and Zn  $72.4 \pm 3.1$  mg/kg. The Cd and Cr content data are not reported because of the paucity of their content. The weight of the whole organic and conventional carrots was comparable. The weight of the whole organic spinach leaf was nearly twice that of the conventional spinach leaf. The texture of the organic spinach leaf was crinkled. The conventional spinach leaf was smooth. Zn content was higher in organic produce. Ni and Cu content were comparable in organic and conventional produce. Pb was lower in organic produce. The average metal content of the organic produce was less than the metal content in conventional produce. However, the difference is too insignificant to pose any danger to the consumer who chooses to consume conventional produce.

## Understanding T3S: Creation of *flgB* null – Danae Stiles and Dr. Jonathan McMurry

### Department of Chemistry and Biochemistry

Pathogenic bacterial infections are a major cause of illness worldwide and rank as the number one cause of death among children and the elderly. Many of these pathogenic bacteria inject proteins into host cells through needle complexes that use Type III secretion. Type III secretion apparatus is also the method by which proteins of the bacterial flagellum self assemble, however, little is known about how this apparatus operates. An understanding in how these proteins interact with each other will lead to a greater understanding of the T3S. The long term expectation for this research is to create a modified export complex in order to observe the interactions among the flagellar proteins. To do this, PCR was used to create a *flgA-flgC* fusion plasmid by removing the *flgB* gene, and success was verified using gel electrophoresis. The resulting plasmid can then be reconstituted into SK6600 cells to produce a *flgB* null strain. However, an attempt at this proved unsuccessful, because SK6600 is a low copy plasmid. The FlgB protein is found in the rod of the basal body and is thought to be essential for basal body formation. Therefore, a mutant of FlgB should only produce the C and MS rings of the basal body. The reconstituted strain should therefore, be nonmotile, but still export protein. An export assay should show that in fact protein is still being exported. This past semester, an export assay was testing in preparation for testing of the FlgB null. An export assay was tested using SJW1103, AJW8800, and the *fliI* null MKM030. The assay proved successful.

## **More Than Meets the Eye: Visualizing Combinatorial Proofs with Graph Theory - *Joey Tyson and Dr. Joe De Maio***

### **Department of Mathematics and Statistics**

Visual illustrations of proof concepts, known as “proofs without words,” have become common practice in modern mathematics. In this project, we establish graph theory as another illustrative tool. Rather than following traditional counting techniques, we couple the visual nature of graphs with the logic of combinatorial proofs. We prove several binomial coefficient identities by analyzing the visual structure of graphs, then also use graphs to prove theorems from number theory. These results not only demonstrate the understanding such proofs can bring, but how graphs can extend identities more easily than traditional counting.

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